




Public Service Commission of Wisconsin Office of Energy
Innovation

Critical Infrastructure Microgrid and Community
Resilience Center Pilot Grant Program

ATTACHMENT A - COVER SHEET



Public Service Commission of Wisconsin
RECEIVED: 08/05/2021 2:05:27 PM

SECTION I - Provide information summarizing the project proposal.				
Project Title:		Bayfield County Highway & Forestry Microgrid Study		
PSC Grant Request (\$):	Applicant Cost Share (\$):	Project Total (\$):		
\$17,865	\$5,925	\$23,790		
Choose one Eligible Activity				
<input checked="" type="checkbox"/> Critical Infrastructure Microgrid Feasibility Study Level 1 and 2		<input type="checkbox"/> Critical Infrastructure Microgrid Feasibility Study Level 3		<input type="checkbox"/> Community Resilience Center Feasibility Study
SECTION II - Provide information for your organization, signatory, and primary contact for the project.				
Applicant Type:	<input type="checkbox"/> City	<input type="checkbox"/> Village	<input type="checkbox"/> Town	<input checked="" type="checkbox"/> County
<input type="checkbox"/> Tribal Nation		<input type="checkbox"/> Wisconsin Technical College System		
<input type="checkbox"/> University of Wisconsin System		<input type="checkbox"/> K-12 School District	<input type="checkbox"/> 501(c)(3) nonprofit	
<input type="checkbox"/> Municipal Utility (water, wastewater, electric, natural gas)			<input type="checkbox"/> Hospital (public or nonprofit)	
Name (on W-9):	Bayfield County			
Address (on W-9):	117 E Fifth Street, PO 878, Washburn, WI 54891			
County or Counties Served by Project:	Bayfield County			
DUNS Number or CAGE Code:	152121419			
NAICS Code:	91110403			
Authorized Representative/Signatory (Person authorized to submit applications and sign contracts)			Primary Contact (if different from Authorized Representative)	
Name:	Mark Abeles-Allison		Name:	
Title:	County Administrator		Title:	
Phone:	715-373-6181		Phone:	
E-mail:	Mark.abeles-allison@bayfieldcounty.wi.gov		E-mail:	
Signature of the Authorized Representative				

Bayfield County

Highway & Forestry Microgrid Study

Summary of Project Budget				
Line	Description	PSC Grant Request	Applicant Cost Share	Total Project Cost
1	Personnel		\$5,925	\$5,925
2	Fringe			\$0
3	Equipment			\$0
4	Supplies			\$0
5	Travel			\$0
6	Contractual	\$17,865		\$17,865
7	Other			\$0
8	Indirect			\$0
Totals		\$17,865	\$5,925	\$23,790
% of Total		75%	25%	

Applicant Comments: Breakdown of contractual request is found in reference materials Appendix C, muGrid SOW. Breakdown of applicant cost share is found in narrative section 3.4.6 Cost Share.

Narrative

3.3 Application Narrative

Project Description

Background

Bayfield County is a local unit of government providing essential public services. Bayfield County is responsible for highway maintenance on over 360 miles of County and State Highways. This service includes snow plowing and deicing, road maintenance and repair, emergency services assistance to county municipalities and emergency response due to flooding or high winds. Bayfield County is called out regularly for emergency response and assistance.

Over the past five years power has gone off at the Highway and Forestry facilities multiple times. When this happens communications, fueling and the ability to perform mechanical work is severely limited.

Bayfield County's goal is to create a microgrid with a generator and battery backup to complement existing solar PV at both the Highway and Forestry Buildings. A functioning microgrid would provide backup power in case of a prolonged outage. At present existing solar does not function during power outages.

Bayfield County's goal is to make the Main Highway Garage and adjacent County Forestry Garage a resilient microgrid. Bayfield County is applying for an Activity 1, Level 2 project.

Project Objective:

The objective of this project is to conduct a feasibility study to size battery and/or generator components to pair with the existing solar arrays and master meter the buildings to create a resilient microgrid. Both buildings have solar PV which offset a major portion of site electricity on an annual basis. Neither site has a backup generator and the solar PV does not function in a power outage. By looking at battery storage, fossil fuel backup generation can be minimized, or potentially eliminated, while allowing the solar PV to function while off grid. muGrid Analytics will co-optimize resilience performance with economic performance to present the county with up to four system configuration options. They will work with the county to determine resilience requirements for the project.

Additionally, muGrid will provide general advisory and consulting throughout the period. This includes participation in meetings, preparation of documents and graphics, cost saving calculations and answering general questions.

3.4.1. [Activities 1 and 2 Only]. Identification of Critical Infrastructure

The Bayfield County Highway Garage is the primary county service center for highway maintenance county wide. The garage serves as a machine/welding shop for vehicle repair, Highway Commissioner and Patrol Superintendent offices, and dispatch center for emergency response for storm related events. In winter the county clears 360 miles of state and county roads with plow trucks and salt/sand spreading to ensure safe travel for all. In summer road maintenance and construction, vegetation clearing, and invasive species eradication are undertaken. At all times highway equipment and personnel is on call for emergency situations be it a blizzard, flood or road failure.

Next door to the Highway Garage is the County Forest Garage. Bayfield County forestry equipment and offices are located in this facility. Bayfield County manages over 170,000 acres of land across the county. Department responsibilities include wildfire management. In addition, Bayfield County shares this same space with the Wisconsin DNR Fire Unit for rural grass fire.

3.4.2. Key Partners and Stakeholders

Bayfield County has a well-established team of partners and stakeholders listed in the table below:

Partners	Role	Responsibility
Bayfield County – Mark Abeles-Allison, County Administrator	Project manager	Oversite and project control
muGrid Analytics – Contact Amy Simpkins, CEO	Engineering, data modeling, technical support	All engineering and technical aspects of study
Cheq Bay Renewables – Bill Bailey	Management, financial support	Assist is study coordination, scheduling and financial overview. Coordinate with Xcel Energy
Northern States Power (Xcel Energy)	Local distribution utility	Code compliance, public safety, technical assistance

Other Partners:

- Bayfield County Highway, Paul Johanik, Jail Administrator
- Bayfield County Forestry, Jason Bodine, Forest Administrator
- Wisconsin DNR, Washburn

A letter of support from Xcel Energy, Bayfield County Highway, Bayfield County Forestry, Cheq Bay Renewables, and a Bayfield County Board Resolution are included in the reference materials, Appendix B.

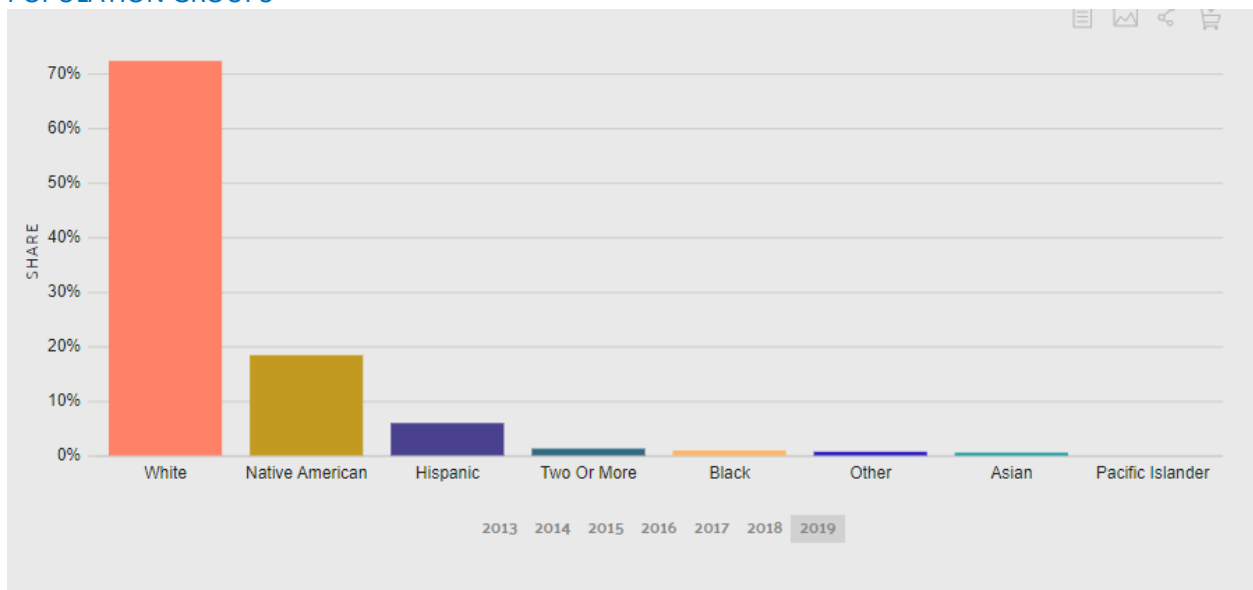
This project will provide equitable engagement of and benefit to communities of color and low-income communities:

The median income for Bayfield County is \$8,000 **below** the state average. The rate of unemployment and those in poverty in Bayfield County is at or above the state average. The average age in Bayfield County is 52.2 versus 39.9 statewide. The Red Cliff Band of Lake Superior Chippewa represent over 18% of the County population.

BAYFIELD COUNTY DEMOGRAPHICS (datausa.io)



POPULATION GROUPS



Power continuation during outages will ensure these populations receive service even during general power outages.

Bayfield County is focused on essential service continuation during severe weather, a very vulnerable times for county residents. The County has a history of energy conservation, renewable and alternate energies and currently is working on a microgrid project connecting the County Courthouse and County Jail.

This next phase includes essential services that keep county emergency services operating. Every county resident and business is affected by road conditions as they engage in commerce and daily routines. Bayfield County is home to 15,000 residents and 424 businesses. 28% of the residents are over 65, 18 are Native American, 10.3% live in poverty, and the per capita income is \$31,825, 5% below

the state average.¹ The study and project if built would help secure the lifelines of the entire Bayfield County population.

3.4.3. Project Resilience Objectives and Metrics

The primary resilience objective is to optimize the generation and storage assets based on the point of connection (POC) determined by the study. To achieve this a series of tasks will be performed:

1. Estimate load profiles
 - a. The County Garage has a data-logger that was installed as part of the 2019 solar PV installation. This logger measures moment-by-moment building usage and will be used to model loads.
 - b. Estimation of missing load data from the Forestry Building
2. Determine microgrid sizing
 - a. Define resilience duration, confidence, and load requirements
 - b. Perform first techno-economic analysis of required generation and storage capacities to meet resilience requirements for both buildings. The analysis output will recommend additional renewable or fossil-fuel based generation alongside the existing solar, and a battery storage size.
 - c. Choose initial generation and storage asset locations
3. Safe and Secure Operation
 - a. Mapping and identification of existing Xcel Energy lines and transformers
 - b. Determine best point of connection (POC) for the master meter and isolation switch
 - c. Model backup system in software for resiliency analysis
 - d. Perform quasi-dynamic steady state analysis to understand worst case voltage
 - e. Develop control strategy
4. Business Considerations
 - a. Metering
 - b. Billing, tariffs, and policy
 - c. Optimize anticipated grid-connected operation of microgrid and estimate utility bill savings
 - d. Build a 25-year pro-forma based on all known expenses and revenues.

Resilience modeling will yield measurable hours and confidence percentage for those hours. These results are displayed in resilience heat maps. For example, resilience modeling results are shown in Appendix D as sample heat maps for the county jail/courthouse microgrid.

3.4.4. Evaluation of Site-specific information

The site is constrained by surrounding development and geographical distance separating them. The County Garage and Forest Garage are serviced by separate underground electrical lines. The study will address these constraints and suggest the best path forward both economically and technically. An opportunity exists to enhance the functionality of the existing solar arrays by integrating them with battery storage and backup generation. They currently do not function when the grid is down.

A description of the buildings and their functions are stated in 3.4.1.

¹ [U.S. Census Bureau QuickFacts: Bayfield County, Wisconsin](#)

Appendix A contains a site map overview of the two buildings and the existing Xcel lines feeding those buildings.

Existing Self-generation Assets		
Site	Technology	Size
County Highway Garage	Solar PV	44.3kW
Forestry Building	Solar PV	8.4kW
Either	Backup Generator	None
Either	Battery Storage	None

The county is familiar with the City of Washburn’s permitting process and was successful in obtaining permits for past solar PV projects. The study will determine if additional permits will be required.

3.4.5. Technologies under consideration

Solar PV already exists at both buildings, installed in 2018 and 2019, so that technology has already been chosen. However, without batteries or backup generation, the solar does not operate when the grid is out. muGrid Analytics has identified that a synthesis exists when solar generation is coupled with battery storage and backup fossil-fuel generation. A graphic representation of this is found in Appendix E. Fossil fuel generation can be minimized and optimized when supported by solar PV and battery storage. There are other economic benefits as well when battery storage can shave peak demand during normal grid operation, reducing demand charges from the utility. The study hopes to find the optimal size for each component and suggest a control strategy to accomplish the county’s goals of resilience and economic savings.

With documented generation characteristics for this area, emission reduction profiles are easily calculated as well as economic savings potential. Operations and maintenance costs are low with solar PV technology and because of the existing facilities an economy of scale is achieved by routinely having access to local experienced technicians.

3.4.6. Cost Match

All stakeholders will donate in-kind cost share to leverage the economic benefit for the OEI grant.

Stakeholder	Hours	Unit	Amount
Cheq Bay Renewables	15	\$100	\$1500
muGrid Analytics	5	\$225	\$1,125
Bayfield County Staff	60	\$55	\$3300
Total	80		\$5925

3.4.7. Data Collection Plan

The proposed microgrid would be eligible to be serviced by a single master meter under Xcel Energy’s new Resiliency Pilot Program tariff. The county is working with Xcel to complete its first microgrid at the jail/courthouse under this tariff. The experienced gained there will be valuable in moving forward with this second microgrid project.

Utility electric bill data is available as well as the data logger (eGauge) at the County Garage which measures building usage as well as solar PV production. The solar arrays also have web-based software where production data and reports are available. muGrid will use this data combined with information from the sites' utility bills for resilience and economic modeling.

3.4.8. Systems Sizing Analysis

muGrid Analytics will perform the system sizing analysis using their proven Resilience First methodology. Once the business-as-usual case is characterized as specified above, they will define specific resiliency requirements which will guide the system design and sizing. They will perform resilience and economic modeling, optimization, design sizing, and grid-connected dispatch strategy using their in-house, mathematical optimization platform, Redcloud, previously used for the county's jail/courthouse microgrid. Redcloud is a best-in-class energy optimization tool validated against NREL's REopt and LBNL's DER-CAM.²

Resilience modeling is still nascent across the industry. Many times, resilience performance is assumed to be deterministic – that there is a single number that defines resilience at a site, perhaps as an average or minimum operating duration. However, muGrid views resilience performance as stochastic, and they will characterize it with both expected outage survival duration and probabilistic confidence levels. Resilience performance is dependent upon several stochastic variables, including, but not limited to weather, solar irradiance, cloud cover, time-of-day and time-of-year of the outage, and load at the facility. Some of these variables have characterizable but not fully predictable cross-correlation – solar conditions and building load may both be affected by the time of day or time of year of the outage, for example. But even if the relationships are characterized, the conditions at the beginning of an outage are never fully known enough to calculate a deterministic resilience duration. Therefore, muGrid analyzes multiple descriptors of resilience performance, including probability, or confidence, for a given duration.

muGrid defines resilience duration as the amount of time the microgrid can support its dedicated loads after a grid outage before the microgrid fails due to lack of power, whether that lack of power is caused by battery depletion, fuel depletion in the generator, or lack of solar irradiance. This is their primary resilience metric. Other important resilience metrics that may be considered include the time to recover of functionality after the first failure (usually enabled by solar power recharging the battery) and the amount of time the microgrid can then run following that recovery, or the secondary resilience duration. All duration values – time to first failure or primary resilience duration, recovery duration, and secondary resilience duration – must be paired with confidence levels in order to be valuable analysis results. The confidence values are not randomly distributed – they are highly correlated to season of year and load conditions at the building and may also be correlated to the time of day. Therefore, resilience performance is not presented as a deterministic number, but rather, as a full graphic capturing the dependency on these other variables.

MuGrid starts by defining the outage duration, confidence level, and load requirements for islanded operation. The minimum resilience requirement will be 4 hours with 98% confidence at 100% critical load, but they will work together with the County to establish longer supported outage durations

² Simpkins, Travis, and Carey O'Donnell. "Optimizing Battery Sizing and Dispatching To Maximize Economic Return." Battcon International Stationary Battery Conference. 2017.

commensurate with the services of the facilities. They then explore a tradespace of system sizes and configurations, holistically designing the solar plant, battery power and capacity, and generator size together to achieve the resilience performance desired. They simulate outages at every hour of the year to demonstrate resilience performance. They co-optimize resilience performance and economic performance to right-size the system.

muGrid Analytics has already produced resiliency heat maps for the jail/courthouse microgrid demonstrating duration and level of confidence to time-to-first-failure (TTFF). A sample of a heat map is found in Appendix D. This type of analysis will be used for this study to first optimally size the battery and/or backup generation components, then run techno-economic analysis to project cost savings. With the load data available from the eGauge, critical loads and times can be identified for further iteration of control strategies.

The microgrid equipment will be able to provide ancillary services such as frequency or real power support, voltage/reactive power support, and Black Start of System Restoration Support, should there be an established program for these services. If there is a program available with defined compensation schemes, they can incorporate the revenue streams from those programs into the economic model. While the system can be sized based on economics, in this case the expectation is that resilience performance will be the primary driver for system sizing.

muGrid will also show performance sensitivity for both resilience and economic performance to fluctuations in load and in weather. As load growth could be a concern due to the adoption of electric vehicles and other electrification initiatives, it is important to understand the effects of load growth on system performance. Load reduction may also be of interest, since load shedding is a powerful tool to increase resilience durations, depending on the facilities' functions during a grid outage. Since weather is variable, muGrid proposes a similar sensitivity study, showing the impact of nominal and extreme weather periods on resilience and economic performance.

3.4.9. Financial Analysis

Once the microgrid system's storage and backup generation components are sized for resilience, muGrid will perform an economic optimization using the combined buildings' load profiles, solar generation, and storage potential. The output of this optimization will be the optimized grid-connected dispatch strategy. For financial assessment muGrid will determine the optimized grid-connected operations and calculate the stacked revenue streams. They then use those revenues to assess the cost-benefit trade-offs and show cost-justification for the microgrid system. They will demonstrate utility bill savings based on saved energy charges from solar generation and self-consumption enabled by the BESS. They will also model any other revenue streams available as determined by the site's rate tariff and utility programs. Revenue streams may include but are not limited to peak shaving (on-site peak demand charge reduction), energy arbitrage (time-shifting solar), and demand response (responding to grid requests during network peaks.) Revenue streams may also include participation in ancillary services programs as noted above.

This modeled result will be used to summarize all costs and benefits. The financial metrics will be shown in a cashflow proforma spreadsheet using common financial metrics such as internal rate of return, net present value, simple payback period, and cumulative cash flow. This information will also assist in determining a financing pathway and applicable grant opportunities will be determined. Peak load shaving from utilizing battery storage is an integral benefit from the system. The county has

demonstrated utility bill savings in their existing solar projects and anticipate similar financial results plus increased resiliency at these two buildings, where there is none now.

3.4.10. Environmental Impact

The county has used the EPA Greenhouse Gas Equivalencies Calculator to showcase environmental benefits of its existing solar installations and will update those benefits once the new microgrid's components are sized. Solar plus battery storage was the chosen technology because of its extensive environmental benefit documentation. The longevity of solar modules and recyclability of the modules and racking components is well documented³. Lithium-ion batteries, albeit more controversial in terms of recycling vs. steel, aluminum or glass, is usually recycled by the manufacturer.⁴

The county was the first county in Wisconsin to achieve 100% carbon-free electricity in all its county owned infrastructure. They received a Letter of Commendation from Governor Evers in February 2020 and is found in Appendix F. They track energy usage and renewable generation in all county owned facilities and produce a report annually that is presented to the Executive Committee and Board of Supervisors. This study continues the county's strong leadership in mitigating climate change with pre-disaster solutions of enhanced resilience by forming microgrids at critical county infrastructure.

3.5. Reference Materials

Appendix A – Site Map

Appendix B – Letters of Support

1. Xcel Energy
2. Cheq Bay Renewables
3. Highway Department
4. Forestry Department
5. County Resolution

Appendix C – muGrid SOW

Appendix D – Sample Resiliency Heat Maps

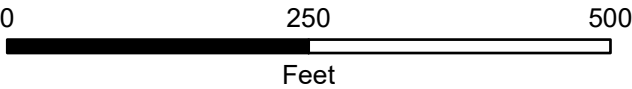
Appendix E – Sustainability and Survivability Graphic

Appendix F – Governor Evers Commendation

³ [Are Solar Panels Recyclable? Here's How to Recycle Them \(greenmatters.com\)](https://greenmatters.com/are-solar-panels-recyclable/)

⁴EnergyPort, a typical manufacturer of the batteries for microgrids has been contacted but we have not received a reply on recommended procedures or other documentation.

BAYFIELD COUNTY HIGHWAY AND FORESTRY MICROGRID FEASIBILITY STUDY



GIS data shown on this map is approximate
and does not substitute for an accurate field survey.





- ★ Bayfield County Highway Garage
- ★ Bayfield County Forestry Garage
- Roads
- Approx. Parcel Lines

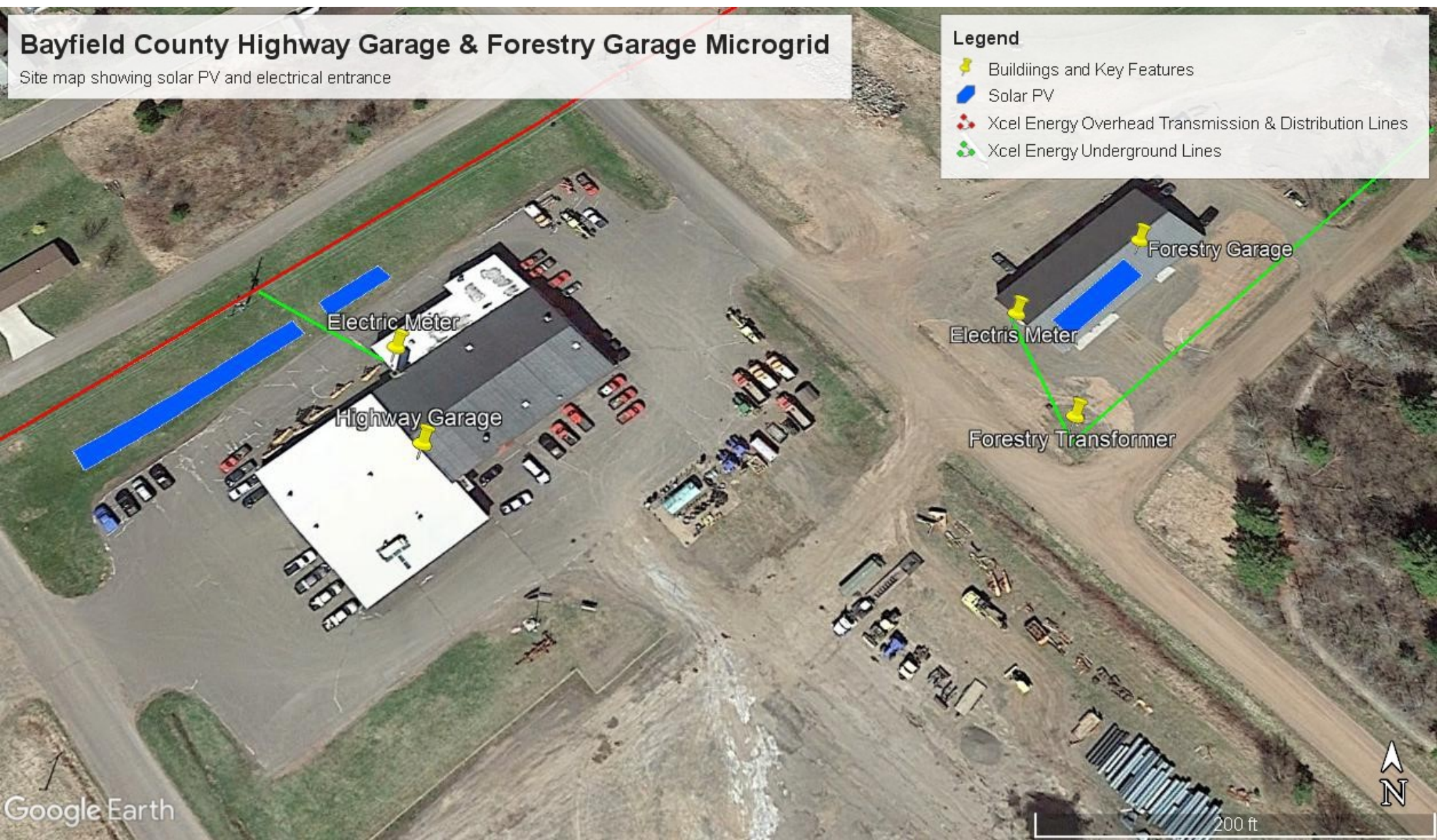


Bayfield County Highway Garage & Forestry Garage Microgrid

Site map showing solar PV and electrical entrance

Legend

-  Buildings and Key Features
-  Solar PV
-  Xcel Energy Overhead Transmission & Distribution Lines
-  Xcel Energy Underground Lines



Google Earth



200 ft



1414 W. Hamilton Ave
P.O. Box 8
Eau Claire, WI 54702-0008

July 27, 2021

Public Service Commission of Wisconsin
Office of Energy Innovation
Hills Farms State Office Building
4822 Madison Yards Way
Madison, WI 53705

Re: Critical Infrastructure Microgrid/ Community Resilience Center Grant

Dear Office of Energy Innovation:

I'm writing to share Xcel Energy's strong support for Bayfield County to receive a grant for a microgrid project feasibility study as part of the Office of Energy Innovation Grant Program from the Public Service Commission of Wisconsin. This feasibility study would help support a microgrid project between the Bayfield County Highway and Forestry facilities that are adjacent to each other in far northern Wisconsin.

As Wisconsin's #1 provider of renewable energy, Xcel Energy has a strong relationship with Bayfield County. Bayfield County was one of the first participants in our Solar*Connect Community program and is also a large subscriber to our Renewable*Connect program. These partnerships helped Bayfield County become the first county in Wisconsin to achieve 100% renewable energy for its own facilities. Xcel Energy also continues to support Bayfield County's ongoing efforts on the development of a rural EV transit project and we are working together, through Focus on Energy, on a community conservation pilot called "Save to Give."

We are excited about the opportunities that this grant would provide Bayfield County as they continue their work to advance this innovative project which includes:

- Providing "lifeline services" for the county, which includes emergency road work and snow plowing.
- A shared facility with the WDNR that has fire response equipment on site.
- Having solar arrays on the Highway and Forestry Buildings which can help facilitate a microgrid.
- Allowing for a generator at the Highway facility which has been a long-range goal of the county.

For these reasons we strongly support approval of a grant to support a feasibility study to further the development of this microgrid project in Bayfield County.

Sincerely,

A handwritten signature in black ink that reads 'Brian Elwood'.

Brian Elwood
General Manager, Customer and Community Service
Wisconsin and Michigan



Cheq Bay Renewables

To: Public Service Commission of Wisconsin- Office of Energy Innovation

Date: August 4, 2021

From: William Bailey, President, Cheq Bay Renewables

RE: OEI- Critical Infrastructure Microgrid & Community Resilience Center Pilot Grant Program:
Cheq Bay Renewables Support Letter

Bayfield County has been an energy leader for several years as they continue to strive to reduce their carbon footprint and increase resiliency in an ever more uncertain world. In recent years rain storms have eroded highways and winter storms have blanketed the area with wetter, denser snow. Several mitigation projects have been realized since 2016 and include replacing and enlarging nearly every culvert on Highway 13, a main access route into and through the county, and replacing several bridges, including one on Highway 2 at Fish Creek, where the main east-west route through the county was disrupted for months.

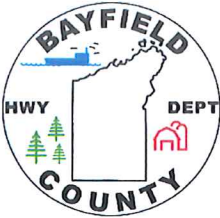
The county's main highway garage in Washburn has no backup power, something the county has long sought after to rectify. The adjacent Forestry Building supports fire suppression in county and state forests and also has no backup power. The community depends on these critical facilities to operate in all seasons and at all times, but especially during emergency situations. To synthesize existing solar PV with battery storage and a smaller more efficient backup generator than would otherwise be required is the goal and would create a microgrid capable of sustaining both facilities for long-duration outages.

Bayfield County has a solid history of working with Xcel Energy. They are the largest subscriber to Xcel's Solar*Connect Community, the community solar installation in Ashland WI. They also have participated in Xcel's Renewable*Connect program to achieve 100% carbon-free electricity in all county-owned infrastructure, and are currently working with Xcel and the OEI to develop the county's first microgrid through Xcel's Resiliency Service Pilot tariff.

I encourage the Office of Energy Innovation to support and fund Bayfield County's Critical Infrastructure Microgrid/ Community Resilience Center Grant application.

Sincerely,

William (Bill) Bailey



Bayfield County Highway Department

PO Box 428

Washburn WI 54891

(715)373-6115

Fax: (715)373-6140

Email: highway@bayfieldcounty.wi.gov

July 15, 2021

Mark Abeles-Allison
Bayfield County Administrator

Re: Generator/Micro-Grid for County Facilities

The Bayfield County Highway Department highly encourages a feasibility study to investigate improving the County's reliability and resiliency using generators and micro grids to ensure power is available during emergencies and outages.

The Highway Department is essential for our citizens, residents, and visitors to the area like the Sheriff's and Emergency Management Departments. When storms and emergencies occur, our department oftentimes must mobilize to maintain safe travel throughout the County.

Having power available at our facilities is imperative to allow access to our fleet and to allow for fueling operations to keep our fleet operational. Having a reliable system in place to ensure we can initiate and continue all needed responses to emergencies is vital.

Sincerely,

A handwritten signature in blue ink, appearing to read "Paul Johanik".

Paul Johanik

Bayfield County Highway Department
Highway Commissioner
PO Box 428
311 South 1st Avenue East
Washburn, WI 54891

A handwritten signature in blue ink, appearing to read "Bob Anderson".

Bob Anderson

Bayfield County Highway Department
Patrol Superintendent
PO Box 428
311 South 1st Avenue East
Washburn, WI 54891



Forestry & Parks Department

117 East Fifth Street - P.O. Box 445 - Washburn, WI 54891

Phone: 715-373-6114 - Fax: 715-373-0114

forestry@bayfieldcounty.wi.gov

August 4, 2021

To: Mark Abeles-Allison, County Administrator
From: Jason Bodine, Forestry and Parks Administrator
Re: Generator/Mirco-Grid for County Facilities

The Bayfield County Forestry and Parks Department encourages a feasibility study to investigate improving Bayfield County's reliability and resiliency using generators and micro-grids to ensure a dependable source of power is available during emergencies and outages.

The Forestry and Parks Department is primarily responsible for the management of the roughly 176,000 acre Bayfield County Forest, numerous campgrounds, day-use parks, and rustic yurts, as well as overseeing the management of hundreds of miles of designated recreational trails. Department staff are often required to mobilize in response to significant storm events, wildfires or when other emergencies occur on the various properties. The Department also shares (leases) a portion of the Forestry garage with the Wisconsin DNR. The DNR provides numerous essential services to the public, including a first response to all wildfire events.

Having reliable power available at our facilities is vital to the continued success of various public programs, particularly during times of emergency.

Sincerely,

Jason Bodine
Forestry and Parks Administrator



Resolution

No. 2021-64

Applying for Highway and Forestry Departments Feasibility Study through State Energy Office

WHEREAS, the Bayfield County Highway Department provides essential “lifeline” services to county residents including road construction and repair, snow plowing, and emergency services; *and*,

WHEREAS, reliable power at all times is important for the department to function and provide emergency response; *and*,

WHEREAS, the Highway Department has investigated backup generators in the past; *and*,

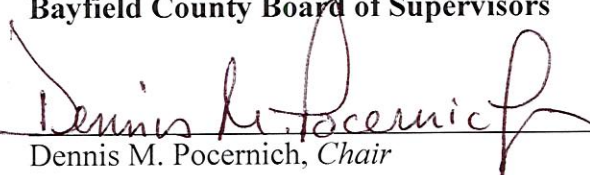
WHEREAS, the County Forestry Office is across the street from the Highway Department and would benefit from more reliable power; *and*,

WHEREAS, the Wisconsin DNR Fire Response Unit is a co-tenant in the Forestry building; *and*,

WHEREAS, the State Energy Office is offering funds to perform feasibility studies to improve the resilience of critical services.

NOW THEREFORE BE IT RESOLVED, that the Bayfield County Board of Supervisors assembled this 27th day of July, does hereby support the application of a Microgrid Feasibility Study for a new generator at the Highway Garage that serves the Bayfield County Forestry Department as well.

By Action of the:
Bayfield County Board of Supervisors


Dennis M. Pocernich, *Chair*

STATE OF WISCONSIN)
) ss.
COUNTY OF BAYFIELD)

I, Lynn M. Divine, Bayfield County Clerk,
hereby certify that the foregoing is a true and
correct copy of Resolution No. 2021-64, Volume
29, adopted by the Bayfield County Board of
Supervisors at their meeting held on the 27th day
of July 2021.


Lynn M. Divine, *Bayfield County Clerk*



August 6, 2021

Mark Abeles-Allison
Bayfield County
Washburn, WI

Dear Mark,

Thank you for the opportunity to continue to support Bayfield County by conducting a microgrid feasibility study in support of increased resilience, sustainability, and economic benefit to critical county infrastructure. muGrid Analytics has worked on other renewable energy and microgrid projects across the state of Wisconsin, including the Bayfield County courthouse/jail microgrid, and we are excited to help Bayfield County continue to achieve their energy goals. We are pleased to offer microgrid modeling, analytics, and design services, as well as energy advising services to the county for the county garage / forestry building microgrid. This quote shall be valid for three (3) months from the date listed above.

Project Name: Bayfield County Garage / Forestry Building

Scope of Work: See below

Budget: Not to exceed \$17,865 USD; see below

We are ready to begin work immediately and very much looking forward to working with you on this important project.

Sincerely,

A handwritten signature in black ink that reads 'Amy'.

Amy Simpkins
CEO, muGrid Analytics



Bayfield County Garage / Forestry Building Microgrid

muGrid Analytics Proposed Scope of Work
Period of Performance: 10/1/2021 – 6/30/2022

Background:

Bayfield County desires to continue to lead Wisconsin and increase sustainability and resilience at the county garage and forestry office facilities, building on their existing distributed energy infrastructure. Bayfield County wishes to develop a microgrid at their garage and forestry office facilities to achieve site resilience in islanded mode with economic benefits while in grid-connected mode. muGrid Analytics is well prepared to support the county in these objectives.

Project Description:

The objective of this feasibility phase of the project is to develop a technical microgrid design and feasibility analysis sufficient to select a technology and move to a final design phase. This will include:

- analyzing available load data to build robust load profiles for the buildings included in the microgrid
- analyzing rate tariffs and utility incentive or ancillary services programs to determine grid-connected revenue streams
- iteration of the definition of resilience and economics requirements with the county to ensure that stated requirements are validated to meet overall goals
- determining the optimal combination and sizing of microgrid components (which may include solar PV, battery energy storage, or firm generation to meet resilience requirements using muGrid's in-house optimization and stochastic modeling tools
- optimization of microgrid economics, utility savings, and predicted resilience performance
- providing budgetary quotes for future design engineering services, equipment, installation, control hardware and software, balance of system, and operations and maintenance
- generating system one-line diagrams and other technical specifications sufficient to specify a final design
- coordinating with Bayfield County and providing provide general advisory and consulting throughout the period of performance. This includes participation in internal or external county meetings, preparation of documents and graphics, and answering general questions.

Ongoing energy advisory services muGrid support in subsequent project phases could include refinement of the microgrid design and financial engineering, continued expert advising throughout the implementation process, economic dispatch control, and performance monitoring of the installed system through the operational phase. These services are not in scope for the initial feasibility study.

Deliverables:



- A comprehensive PowerPoint slide deck detailing all modeling assumptions and results
- An Excel spreadsheet proforma with 25-year cashflows for each system configuration studied
- Writing a final study report.

Period of Performance

The period of performance runs from contract execution through June 30, 2022, as specified by the WI OEI Critical Infrastructure Microgrid & Community Resilience Center Pilot Grant Program.

Other Conditions and Constraints

1. This phase of the project will result in a microgrid solar design and analysis. Final engineering design will need to be conducted by a licensed Professional Engineer and is not included in this proposal.
2. muGrid Analytics does not represent or warrant that the execution of definitive documents with respect to any project in the feasibility phase will lead to the achievement of commercial operation of such project. All final decisions are Bayfield County's and Bayfield County bears the responsibility thereof.

Budget:

The project will be billed actual hours according to the rate schedule below:

Work Type	Hourly Rate
<i>Principal Consultant</i>	\$225
<i>Design Engineer</i>	\$150
<i>Analyst</i>	\$60

muGrid will be pleased to contribute 5 hours of Principal Consultant time as an in-kind contribution to the project and cost share.

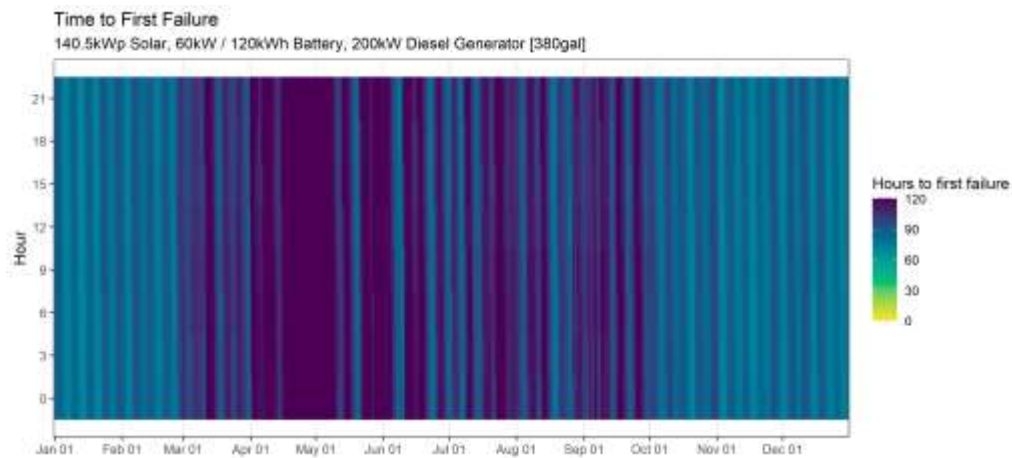
The Work Breakdown for each task is expected as follows (next page):

Task	Principal h	Design Engineering h	Analyst h	Trips
<i>Rate</i>	<i>225</i>	<i>150</i>	<i>60</i>	<i>900</i>
Analyze load data and develop load profile	3	3	4	
Analyze rate tariff and revenue streams	3	3	4	
Coordinate with Xcel Energy on master metering strategy and interconnection options	3	6		1
Refine resilience requirements	2		2	
Size microgrid system based on resilience performance requirements	4	10	15	
Optimize grid-connected economics and resilience performance of selected systems	4		8	
Identify onsite locations for microgrid equipment and Xcel equipment	3	6		
Provide vendor quotes, preliminary one-line drawings, and other technical information sufficient to request proposals	4	8	6	
Meetings	4	4		
Reporting	4	8	15	
Subtotals	\$ 7,650	\$ 7,200	\$ 3,240	\$ 900
In kind contribution / cost share	5			
Totals	\$ 6,525	\$ 7,200	\$ 3,240	\$ 900
TOTAL PROJECT BUDGET	\$ 17,865			

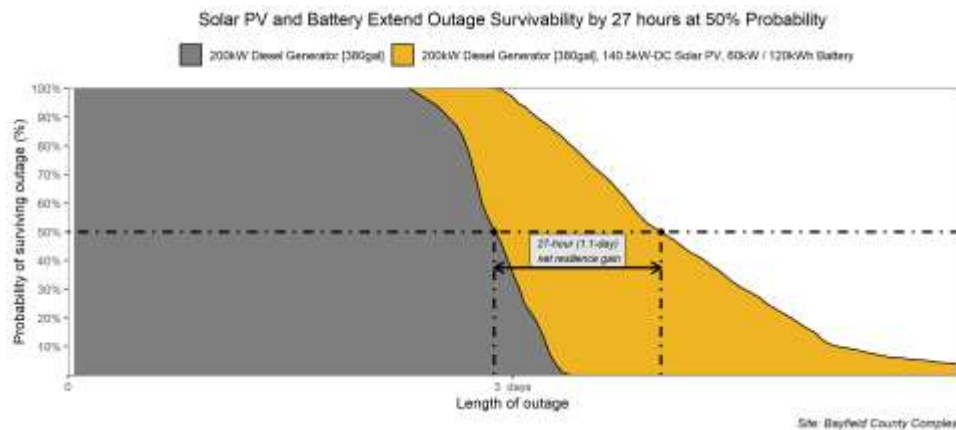
Appendix D - Sample resilience analysis from the jail/courthouse

The following figures show results from a resilience analysis performed at the Bayfield County Courthouse and Jail. This analysis helped to secure grant funding for implementation from Wisconsin OEI in early 2021.

The first figure shows a heat map of the anticipated time-to-first-failure of the solar-battery-generator microgrid for outages starting at every hour of the year. The hours of the day are on the vertical axis, while the months of the year are on the horizontal axis. Darker, purple colors represent longer outage durations, 5 days and longer. The lighter blue colors provide support for around 72 hours. With 98% confidence, this microgrid can support these two buildings for 71 hours at any time of day, any day of the year.

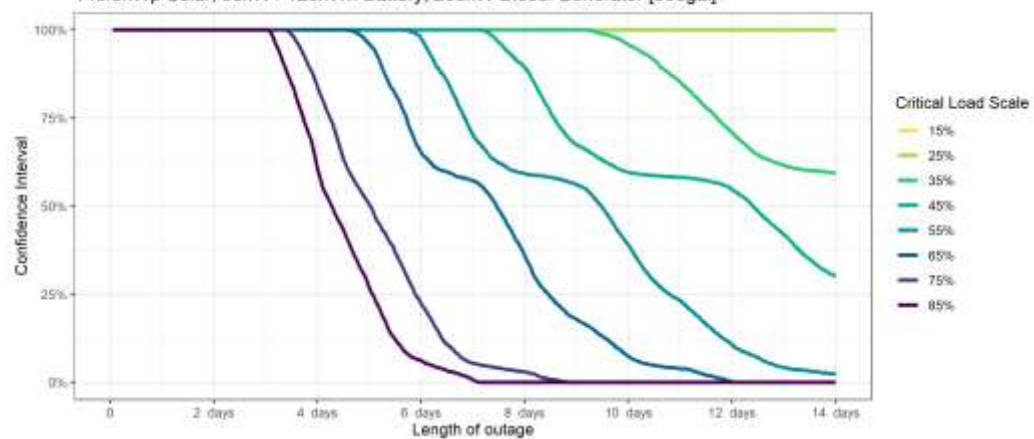


The next image shows the power of the microgrid. Solar-plus-storage extends the outage survivability of a generator alone by over a day at 50% confidence. We anticipate the garage-forestry office microgrid to show similar or better performance by solar-plus-storage.



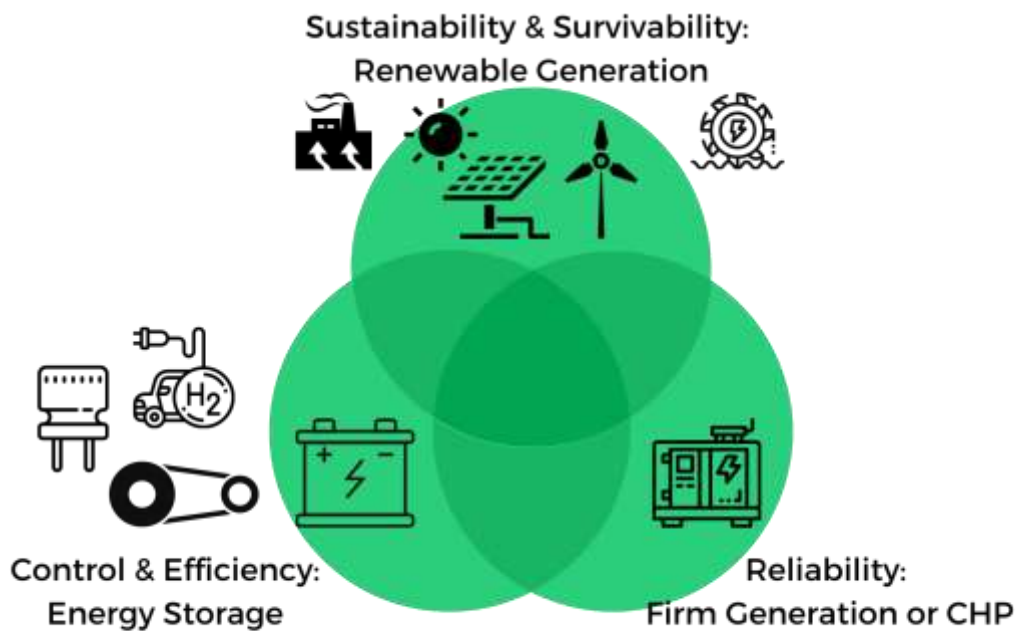
The final graphic shows a look at resilience performance sensitivity to load shedding. For example, if the load at this site were reduced to around 50% of its normal operations, the microgrid would support a week of outage duration with very high confidence.

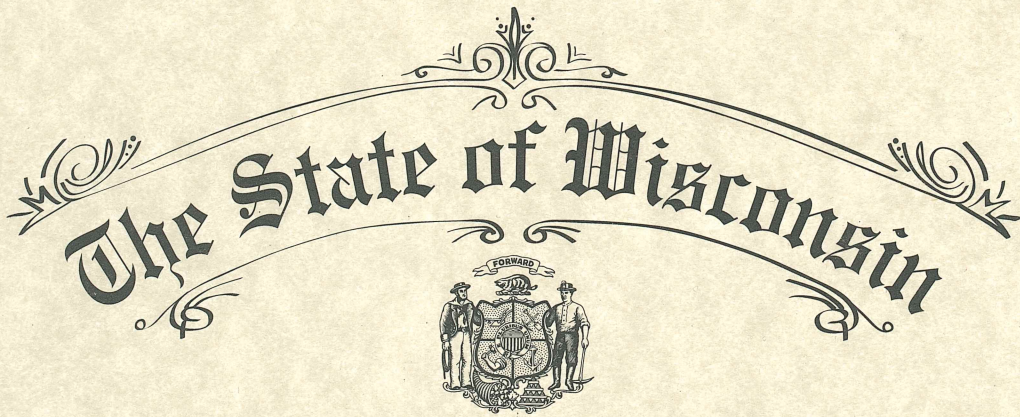
140.5kWp Solar, 60kW / 120kWh Battery, 200kW Diesel Generator [380gal]



Appendix E – Sustainability and Survivability Graphic

The following graphic represents the symbiosis between renewable generation, energy storage and conventional backup generation. The three components enhance each other making a greater sum than any one alone and specifically enables more efficient use of fossil-fuel backup generation. The relationship reduces fossil-fuel run time and when it is necessary to run, it can charge batteries and carry the building load operating at a higher efficiency. When the batteries are charged, the backup generator shuts off, something they would not do without them.





OFFICE OF THE GOVERNOR

CERTIFICATE OF COMMENDATION

HONORING BAYFIELD COUNTY

WHEREAS; in 2008, Bayfield County adopted the Wisconsin Public Service Commission's 25 x 25 plan toward the goal of sourcing 25 percent of electricity and 25 percent of transportation fuels from renewable energy sources by the year 2025; and

WHEREAS; throughout the past decade, Bayfield County has implemented a wide range of energy conservation, alternate energy, and renewable energy projects designed to reduce the county's energy consumption and carbon footprint in concert with Cheq Bay Renewables; and

WHEREAS; in 2018 and 2019, Bayfield County purchased 190 kilowatts from the Xcel Energy Ashland Solar Garden and installed over 140 kilowatts of solar at the Bayfield County Jail and Highway Garage in coordination with Focus on Energy and the Wisconsin State Office of Energy Innovation; and

WHEREAS; in 2019, Bayfield County used 986,700 kilowatt-hours of electricity, of which 74% will be carbon-free in 2020, and this year, 2020, Bayfield County has committed to participating in renewable energy programs made available by Xcel Energy and Bayfield Electric in order to reach 100% Carbon-Free Electricity for Bayfield County facilities;

NOW, THEREFORE, I, Tony Evers, Governor of the State of Wisconsin, hereby recognize Bayfield County's community-wide focus on renewable and carbon-free energy production, as well as the progressive mix of renewable and carbon-free energy offered by Bayfield County's utilities.

DONE AT THE CAPITOL IN
THE CITY OF MADISON THIS
25th DAY OF FEBRUARY 2020.

A handwritten signature in black ink, reading 'Tony Evers', is written over a horizontal line.
TONY EVERS
GOVERNOR

